DOCKET NO.: UPFF-0004 / N2437 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: **Gorte, *et al.***	Confirmation No.: **5527**
Serial No.: **10/053,085**	Group Art Unit: 1795
Filing Date: **November 9, 2001**	Examiner: **Wang, Eugenia**

For: **USE OF SULFUR-CONTAINING FUELS FOR DIRECT OXIDATION FUEL CELLS**

Electronically Filed: December 8, 2009

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Commissioner for Patents
P.O. Box 1450
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Sir:

APPELLANTS' BRIEF PURSUANT TO 37 C.F.R. § 41.37

This brief is being filed in support of Appellants' appeal from the final rejections of claims 2-30, 55, 56, 58-60, 62-64, and 66 (claim 66 is now canceled), dated April 10, 2009. A Notice of Appeal was filed on October 9, 2009.

1. REAL PARTY IN INTEREST

The real party in interest is the University of Pennsylvania, an educational institution located in Philadelphia, PA. The present application has been licensed by Franklin Fuel Cells, a division of American Refining Biochemical, a U.S. corporation having its principal office in Conshohocken, PA.

2. RELATED APPEALS AND INTERFERENCES

No related appeals of interferences are pending.

3. STATUS OF CLAIMS

Pending:	Claims 2-19, 21-30, 55-56, 62-64
Rejected:	Claims 2-19, 21-30, 55-56, 62-64
Objected to:	None
Allowed:	None
Withdrawn:	None
Appealed:	Claims 2-19, 21-30, 55-56, 62-64
Appeal Withdrawn:	None

4. STATUS OF AMENDMENTS

Certain claims were amended subsequent to the final rejection dated April 10, 2009, so as to overcome certain rejections under 35 U.S.C. § 112 and to place the pending claims in better condition for appeal. All of these amendments were entered and all rejections under 35 U.S.C. § 112 were withdrawn by office action dated November 17, 2009. The only remaining rejections in this case are rejections under 35 U.S.C. § 103.

5. SUMMARY OF CLAIMED SUBJECT MATTER

The following summary is for the purpose of complying with the provisions of 37 C.F.R. § 41.37(c)(1)(v). The entire disclosure should be reviewed to obtain a complete understanding of the claim language. Citations to the specification are by paragraph number, e.g., "[0001]" and citations to the figures are by figure number, *e.g.*, "[Fig. 1, reference numeral 100]."

Claim 62	
Claim Language	**Citation to specification and drawings**
A solid oxide fuel cell system capable of directly operating with a sulfur-containing hydrocarbon fuel that does not undergo prior treatment to remove organic sulfur compounds, comprising:	Pre-grant Published Application ("PGPUB") at Abstract, [0003], [0014]-[0016], [0024]-[0026], [0063], [0089]
(a) a solid electrolyte comprising an electronic insulator that allows transfer of anions;	PGPUB at Abstract, [0023], [0025], [0031], [0043]

(b) an essentially nickel-free porous anode containing at least ceria deposited in the pores, the anode further comprising a ceramic, and at least a portion of the anode being bound to the electrolyte;	PGPUB at Abstract, [0028]-[0030], [0051]-[0053], [0058], [0071], [0089], [0090], Figure 3, Figure 4b
(c) a cathode;	PGPUB at Abstract, [0023], [0025], [0031]
(d) a fuel comprising a hydrocarbon having 2 or more carbons, and the fuel being characterized as having a sulfur content of from about 1 ppm to about 5000 ppm; and	PGPUB at Abstract, [0024], [0061]-[0063]
(e) an oxygen source;	PGPUB at Abstract, [0023], [0025]
wherein the solid electrolyte and the porous anode overlap one another so as to define a region of physical contact between one another, the region of physical contact being characterized as an essentially uninterrupted interface.	PGPUB at Abstract, [0028]-[0030], [0051]-[0053], [0058], [0071], [0089], [0090], Figure 3, Figure 4b

Claim 63	
Claim Language	**Citation to specification and drawings**
A process of producing electrical energy, comprising:	
(a) providing a solid oxide fuel cell system capable of directly operating with a sulfur-containing hydrocarbon fuel that does not undergo prior treatment to remove organic sulfur compounds, the solid oxide fuel cell system comprising:	Pre-grant Published Applicatoin ("PGPUB") at Abstract, [0003], [0014]-[0016], [0024]-[0026], [0063], [0089]
a solid oxide electrolyte comprising an electronic insulator that allows transfer of anions;	PGPUB at Abstract, [0023], [0025], [0031], [0043
an essentially nickel-free porous anode containing at least ceria deposited in the pores, the anode further comprising a ceramic, and at least a portion of the anode being bound to the electrolyte; and	PGPUB at Abstract, [0028]-[0030], [0051]-[0053], [0058], [0071], [0089], [0090], Figure 3, Figure 4b
a cathode,	PGPUB at Abstract, [0023], [0025], [0031]

wherein the solid electrolyte and the anode overlap one another so as to define a region of physical contact between one another, the region of physical contact being characterized as an essentially uninterrupted interface,	PGPUB at Abstract, [0028]-[0030], [0051], and [0071], Figure FIG. 4b
(b) contacting the cathode with an oxygen source; and	PGPUB at [0025], [0032]
(c) contacting the porous anode with the fuel.	PGPUB at [0032]

Claim 64	
Claim Language	**Citation to specification and drawings**
A solid oxide fuel cell system capable of directly operating with a sulfur-containing hydrocarbon fuel that does not undergo prior treatment to remove organic sulfur compounds, comprising:	Pre-grant Published Applicatoin ("PGPUB") at Abstract, [0003], [0014]-[0016], [0024]-[0026], [0063], [0089]
(a) a solid electrolyte comprising an electronic insulator that allows transfer of anions;	PGPUB at Abstract, [0023], [0025], [0031], [0043]
(b) an essentially nickel-free porous anode containing at least copper deposited in the pores, the anode further comprising a ceramic, and at least a portion of the anode being bound to the electrolyte;	PGPUB at Abstract, [0020], [0027]-[0030], [0042], [0051]-[0053], [0055], [0057], [0058] [0065], [0071], [0089], [0090], Figure 3, Figure 4b
(c) a cathode;	PGPUB at Abstract, [0023], [0025], [0031]
(d) a fuel comprising a hydrocarbon having 2 or more carbons, and the fuel being characterized as having a sulfur content of from about 1 ppm to about 5000 ppm; and	PGPUB at Abstract, [0024], [0061]-[0063]
(e) an oxygen source;	PGPUB at Abstract, [0023], [0025]
wherein the solid electrolyte and the porous anode overlap one another so as to define a region of physical contact between one another, the region of physical contact being characterized as an essentially uninterrupted interface.	PGPUB at Abstract, [0028]-[0030], [0051]-[0053], [0058], [0071], [0089], [0090], Figure 3, Figure 4b

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

- Rejection of claims 2, 3, 5-12, 15, 16, 18, 21, 24-30, 62, 63, and 66 (claim 66 has been canceled) as allegedly obvious over Cable (U.S. Patent 5,445,903) in view of Isenberg (U.S. Patent 4,812,329) and Keegan (U.S. Patent 6,423,896)
- Rejection of claims 4, 13, 14, and 23 as allegedly obvious over Cable 903 in view of Isenberg and Keegan, as applied to claims 62, 10-12, 63, and 22, and in further view of Anumakonda (U.S. Patent 6,221,280)
- Rejection of claims 17 and 19 as allegedly obvious over Cable '903 in view of Isenberg and Keegan, as applied to claims 62, 15, and 16, and in further view of Wallin (U.S. Patent 6,017,647)
- Rejection of claims 55, 56, and 60 as allegedly obvious over Cable '903 in view of Isenberg and Keegan, as applied to claims 62, 63, 65, and 66 (now canceled), in further view of Cable (U.S. Patent 5,589,285)
- Rejection of claims 58 and 64 as allegedly obvious over Cable '903 in view of Isenberg and Keegan, as applied to claims 62, 63, 65, and 66 (now canceled), in further view of Cable '285.

7. ARGUMENT

At issue in this appeal are the rejections of independent claims 62, 63, and 64 under 35 U.S.C. § 103(a) as allegedly obvious in view of certain prior art. The other rejections in this matter will stand or fall based on resolution of the rejections of these independent claims. *E.g.*, *In re Fine*, 837 F.2d 1071, 1076 (Fed. Cir. 1988) (dependent claim is nonobvious if independent claim from which it depends is itself nonobvious).

A. Summary of Argument

The pending claims recite solid oxide fuel cells that include, *inter alia*, a solid electrolyte and a ceramic anode bonded to one another. These fuel cells are capable of directly operating on a sulfur-containing hydrocarbon fuel having two or more carbons, which enables efficient extraction of energy from such fuels without the need for costly, energy-inefficient reformation of the fuel or other pre-treatment processes.

The pending claims stand finally rejected as allegedly obvious over various combinations of prior art references. But a review of the cited prior art and the pending application reveals that (1) the rejections are based upon references that teach away from

combination with one another; (2) the rejections are based upon references that teach away from the claimed invention; (3) the rejections are based upon the Examiner's misreading of one of the references; and (4) the proposed reference combinations, even if proper, fail to address every limitation of Appellants' claims.

First, the Examiner's proposed prior art combination is contrary to established patent law. While the Examiner suggests that the Cable and Isenberg references can be combined, a review of the references reveals that while Isenberg (and the claimed invention) recite fuel cells comprising electrodes that are bound to electrolytes, Cable expressly criticizes such bonded assemblies. Cable thus teaches away from its combination with the Isenberg reference and away from the claimed invention, and accordingly cannot support a *prima facie* case of obviousness. Ostensibly seeking to sidestep the fact that Cable teaches away from bonded electrode-electrolyte assemblies, the Examiner proposes that Cable nonetheless teaches such bonded assemblies. But this interpretation of Cable misreads the reference and provides no support to the Examiner's position.

In any event, even if the cited references were properly combinable, the resulting combination would nonetheless fail to address every element of the pending claims and would still to make out a *prima facie* case of obviousness. The rejections should be vacated and the pending claims passed to allowance.

B. Legal Standard – Patentability

As explained in *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992) (citations omitted):

> [T]he examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a *prima facie* case of unpatentability. If that burden is met, the burden of coming forward with evidence or argument shifts to the applicant.
>
> After evidence or argument is submitted by the applicant in response, patentability is determined on the totality of the record, by a preponderance of evidence with due consideration to persuasiveness of argument.
>
> If examination at the initial stage does not produce a *prima facie* case of unpatentability, ***then without more the applicant is entitled to grant of the patent*** (emphasis added).

Thus, the Board must first determine whether the Examiner has established a *prima facie* case of unpatentability before turning to Appellants' position on appeal. *Id.* If the

Examiner fails to establish a *prima facie* case of unpatentability, the applicant is entitled to grant of the patent. *Id.*

C. Rejections Under 35 U.S.C. § 103

The Examiner proposes that the pending claims are obvious in view of various prior art combinations. But because these reference combinations are improper as a matter of Federal Circuit law and fail to address every limitation of the claimed invention, the Examiner has failed to make out a *prima facie* case of obviousness and the rejections should be reconsidered and withdrawn.

1. Legal Standard – Obviousness

To establish a *prima facie* case of obviousness under 35 U.S.C. § 103(a), there must be a clearly articulated reason or rationale, either in the prior art itself or in the knowledge generally available to one of ordinary skill in the art, why the claimed invention is obvious in light of a reference or combined reference teachings. *KSR International Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1739-43 (2007). There must also be a reasonable expectation of success. *Id.* The prior art combination must address every element of the claim at issue. *In re Schreiber*, 128 F.3d 1473, 1480 (Fed. Cir. 1997) ("Patentability is determined for the invention as claimed, ***with all its limitations***.") (emphasis added). The rationale to make the claimed combination and the reasonable expectation of success must be found in the prior art and may not be based on impermissible hindsight or the applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 493 (Fed. Cir. 1991). In all cases, "rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *KSR*, 127 S. Ct. at 1739-43.

2. Discussion

a. Separate Argument for Independent Claims 62, 63, and 64

The other rejections in this matter will stand or fall based on resolution of the rejections of independent claims 62, 63, and 64.

i. Prior Art Summary

The systems recited in claims 62-64 overcome a number of challenges set forth in the very prior art upon which the Examiner relies. As an initial matter, the art the Examiner cited makes clear that there is a need in the art for sulfur-tolerant fuel cells. *E.g.*, Isenberg 329 at col 1, lines 50-52 ("[w]hat is needed is a sulfur tolerant anode structure"). This is a need that

the present invention – entitled "Use Of Sulfur-Containing Fuels For Direct Oxidation Fuel Cells" – addresses.

The Isenberg 329 and 766 references, upon which the Examiner relies, recite electrodes that are bonded to the underlying electrolyte. *See* Isenberg 766 at col. 1, lines 54-56 & **FIG. 1**; *see* Isenberg 329 at col. 3, line 67 – col. 4, line 11, col. 4, lines 45-47 & **FIG. 3**. These bonded assemblies, however, exhibit poor performance, and were later criticized by the subsequent Cable 903 and 285 references, upon both of which the Examiner relies. First, the Cable 903 reference (filed September 9, 1993) criticized bonded electrodes as follows:

> Cermet electrodes for solid oxide electrochemical fuel cells, preferably tubular in shape, are disclosed in ***U.S. Pat. No. 4,582,766 to Isenberg*** et al. Electronic conductors (metals) form the electrode and are bound to the electrolyte by a ceramic coating which is preferably the same material as the electrolyte. The metal electrode particles are oxidized and then reduced to form a porous metal layer which contacts both the ceramic coating and the metal electrode particles. ***The problems of ceramic-metal thermal expansion mismatch are not solved, and are indeed increased by the electrolyte/electrode bound structure***. Cable 903 at col. 1, lines 29-43 (emphasis added).

The subsequent Cable 285 reference (filed May 31, 1995) intensified this criticism, observing that bonded electrodes performed poorly:

> The performance degradation experienced using sulfur bearing fuels with cofired or bonded solid oxide electrolyte fuel cells prompted Westinghouse to modify the anode bonded to the electrolyte by coating the anode with a gas permeable oxygen-ionic-electronic conductor material coating which was sinter or diffusion attached, disclosed in U.S. Pat. Nos. 4,702,971 and ***4,812,329 to Isenberg***. A cell having such a coated fuel electrode was tested for 16 hours using a hydrogen, carbon monoxide, water vapor fuel ***containing 50 ppm hydrogen sulfide and experienced 4.7% performance loss. Extended operation, or thermal cycling caused the anode coating to crack and flake off, however, and resulted in the poisoning of the underlying bonded anode***.
>
> Additional sulfur tolerance test results by Westinghouse for cofired or bonded fuel cells are contained in the final technical report to the U.S. Department of Energy, "Anode Development For Solid Oxide Fuel Cells", Report No. DOE/MC/22046-2371, December 1986. Various anode materials were tested in cofired or bonded fuel cell designs using a hydrogen, carbon monoxide, water vapor fuel containing sulfur species in amounts of 2 ppm, 10 ppm, 25 ppm and 50 ppm. ***The report concluded that cell performance degraded rapidly for about***

> ***the first two hours of sulfur bearing fuel utilization, and at a slow, linear rate thereafter, in the presence of as low as 2 ppmv H_2S in the fuel***. (Cable 285 at col. 2, lines 14-45).

Thus, the Cable references relied upon by the Examiner expressly criticize – ***by name*** – the very two Isenberg references that Examiner proposed to combine with the Cable references. Rather than employing bonded electrode-electrolyte assemblies, the Cable references instead recite so-called "microslip" zones between the electodes and electrolytes of those inventions so as to avoid the problems observed in Isenberg's bonded assemblies. *E.g.*, Cable 903 at col. 2, line 66.

The Isenberg reference describes disposition of ceria in the pores of that reference's electrodes. *See* Isenberg 329 at col. 6, lines 12-43. The performance of such devices, however, was poor and was roundly criticized by the subsequent Cable references. *See* Cable 285 at col. 2, lines 14-45; Cable 903 at col. 1, lines 29-43.

Isenberg described operations on only hydrogen and one-carbon fuels and not on fuels containing two or more carbons, Isenberg 329 at col. 2, line 66.* In any event, devices made according to the Isenberg patents exhibited poor performance on sulfur-containing fuel, as the Cable references pointed out. Cable 285 at col. 2, lines 14-45; Cable 903 at col. 1, lines 29-43.

ii. The Rejection Of Claim 62 Over Cable '903 In View Of Isenberg 329 And Keegan Should be Withdrawn

The Examiner first alleges that claims 2, 3, 5-12, 15, 16, 18, 21, 24-30, 62, 63, and 66 (claim 66 has been canceled) are obvious over Cable (U.S. Patent 5,445,903) in view of Isenberg (U.S. Patent 4,812,329) and Keegan (U.S. Patent 6,423,896) (final office action at pages 3-8). Because the proposed combination of references is improper and because the combination does not suggest or otherwise address every element of the cited claims, this rejection (and the rejection of all related dependent claims) should be withdrawn.

A. Technical Background – Claim 62

As set forth in the claims appendix attached hereto, independent claim 62 recites fuel cell systems that include a sulfur-containing hydrocarbon fuel that does not undergo prior treatment to remove organic compounds. These systems enable power production without

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* Appellants presented evidence that fuels containing two or more carbons would be expected to behave differently than hydrogen or one-carbon fuels (see Response filed January 26, 2009; see also Raymond J. Gorte declaration, attached hereto at pages 30-32).

the inefficiency of having to first process the fuel before introduction to the fuel cell, which pre-processing reduces the overall efficiency of the power generation process.

As recited in claim 62, the fuel cells of the systems include, *inter alia*, a solid electrolyte and an essentially nickel-free, porous ceramic anode. At least a portion of the anode is bound to the electrolyte. The systems include a fuel having from about 1 to about 5000 ppm sulfur and an oxygen source.

B. Because Cable and Isenberg Expressly Teach Away From Their Combination, The Cable-Isenberg Combination Is Improper and Cannot Support the Obviousness Rejection

The Examiner suggests that Cable and Isenberg may be combined to arrive at the claimed invention (office action at pages 3-6). But these references teach away from combination with one another ***and*** away from the claimed invention. Their combination is accordingly improper as a matter of controlling Federal Circuit law and cannot support the proposed obviousness rejections.

It is a fundamental principle of patent law that an obviousness rejection may not be based on a combination of references that teach away from their combination. *E.g.*, *Ecolochem, Inc. v. Southern Cal. Edison Co.*, 227 F.3d 1361, 1373-75 (Fed. Cir. 2000) (reversing district court's finding of obviousness where cited references taught away from their combination); *In re Grasselli*, 713 F.2d 731, 743 (Fed. Cir. 1983) (references that taught away from their combination cannot be combined to support obviousness rejection). References that teach away from the claimed invention likewise cannot support an obviousness rejection. *See W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1550 (Fed. Cir.) (reversing district court's finding of obviousness where district court erred by "disregarding disclosures in the references that diverge from and ***teach away from the invention at hand***") (emphasis added), *cert. denied*, 469 U.S. 851 (1984). Ignoring this controlling precedent, the Examiner nonetheless combined references that teach away from one another ***and*** from the claimed invention.

A review of the Cable and Isenberg references makes plain that the references teach away from combination with one another. As mentioned above, the Cable 285 and 903 references expressly criticizes the bonded electrodes described by the Isenberg 766 and 329 references. Cable 285 at col. 2, lines 14-45; Cable 903 at col. 1, lines 29-43. The Cable references then state that the shortcomings of the Isenberg invention may be overcome by ***avoiding*** bonding between the electrode and electrolyte, which may be accomplished through

separating the electrode and the electrolyte. Cable '903 at col. 2, lines 46-52; Cable 285 at col 3, lines 1-3. The Cable references thus expressly warn against using Isenberg's bonded electrode approach, and references that teach away from one another may not be combined to support an obviousness rejection. *Ecolochem*, 227 F.3d at 1373-75 (reversing district court's finding of obviousness where cited references taught away from their combination); *In re Grasselli*, 713 F.2d at 743 (references that taught away from their combination cannot be combined to support obviousness rejection). Accordingly, because the Cable-Isenberg combination is contrary to controlling law, the references cannot support a *prima facie* case of obviousness and the rejections should be reconsidered and withdrawn.

C. Because Cable Teaches Away From The Claimed Invention, the Cable-Isenberg Combination Is Improper and Cannot Support the Obviousness Rejection

In addition to teaching away from their combination, the cited references also teach away from the claimed invention. Governing Federal Circuit law is clear that references that teach away from the claimed invention cannot support an obviousness rejection. *See W.L. Gore*, 721 F.2d at 1550 (reversing district court's finding of obviousness where district court erred by "disregarding disclosures in the references that diverge from and ***teach away from the invention at hand***") (emphasis added).

Despite this clear guidance from the Federal Circuit, the Examiner nonetheless combined references that teach away from one another ***and*** from the claimed invention. While the claimed invention recites that the anode and electrolyte are bound to one another, the cited Cable 903 and 285 references – as explained above – ***expressly criticize*** such bonding, and instead advocates the disposition of so-called "microslip zones" between the electrolyte and the electrode components (Cable '903 at col. 5, lines 53-68). Because a reference that teaches away from the claimed invention can not render the claimed invention obvious, *W.L. Gore*, 721 F.2d at 1550, the proposed combination is legally improper and cannot support the proposed rejections.

D. The Examiner's Suggestion That Cable '903 Teaches Electrodes And Anodes Bound To One Another Misreads the Reference and is Impermissibly Speculative

Seeking to sidestep the fact that Cable expressly criticizes Isenberg's bonded electrode-electrolyte approach, the Examiner suggests that Cable discloses anodes and electrolytes that are bound to one another. But the Examiner misreads the Cable reference.

More specifically, the Examiner suggests (at least twice) that the Cable '903 reference teaches bonding between an electrode and an electrolyte:

> "As seen in fig. 1 [of Cable '903] , the solid electrolyte and the anode [4] are placed next to one another (overlap), in physical contact ***(and are thus bound to one another)***" (final office action at page 5) (emphasis added)
>
> "Fig. 1, which is embodied by Cable '903, shows ***direct bonding between the anode and the electrolyte*** as well" (final office action at page 23 (emphasis added)

The Examiner's interpretation of the reference is impermissibly speculative. Appellants agree that Figure 1 of the Cable '903 reference shows an anode and an electrolyte ***next to*** one another. But nowhere does the Cable '903 reference state that the anode and electrolyte are ***bound to*** one another, and a reference may not be interpreted to include a feature that might be present: "[t]he mere fact that a certain thing **may result** from a given set of circumstances ***is not sufficient***." *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999) (emphasis added); *see also Perricone v. Medicis Pharm. Corp.*, 432 F.3d 1368, 1379 (Fed. Cir. 2005) (rejection improper where rejection "assume[d] what [the prior art] neither disclosed nor rendered inherent"). The reference provides no description of any bonding between the two elements, and the Examiner's suggestion that Cable describes anodes and electrolytes bound to one another is based on impermissible speculation. *See In re Robertson*, 169 F.3d at 745 (that a certain feature "may result" is insufficient to support rejection). The Examiner's suggestion that Cable '903 teaches bonded electrode-electrolyte assemblies overreads the reference and accordingly does not support the rejections at issue. *See In re Rijckaert*, 9 F.3d 1531, 1534, (Fed. Cir. 1999) ("Obviousness cannot be predicated on what is unknown.")

Moreover, the Examiner's suggestion that Cable '903 teaches bonded anode-electrolyte assemblies is also contrary to the stated goal of the reference. As previously discussed, the stated goal of the Cable '903 reference is to ***avoid*** the problems associated with

bonding the anode to the electrolyte (Cable '903 at col. 2, lines 38-41). Accordingly, the Examiner's suggestion that the Cable '903 reference does not teach away from bonded anode-electrolyte assemblies cannot be reconciled with the fact that the reference expressly criticizes such assemblies. The Examiner's supposition that Cable '903 can be combined with Isenberg is inconsistent with the content and the purpose of the reference, and cannot support a *prima facie* case of obviousness.

E. The Examiner's Supposition That The References Can Be Combined Fails To Explain Why One Of Ordinary Skill In The Art Would Disregard The References' Express Teaching Away

The Examiner also proposes, at various places, that Cable and Isenberg can be combined because the two references are only being used to address sulfur tolerance and that one of skill in the art can, for that reason, disregard the references' teaching away (final office action at, *e.g.*, page 23, 28). But because the Examiner never explains why one of ordinary skill in the art would disregard a teaching away that goes directly to a limitation (*i.e.*, bonded electrodes) of the pending claims, the Examiner's position frustrates the long-recognized goal of avoiding rejections based on mere hindsight.

As the Supreme Court recently reaffirmed, "rejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *KSR Int'l v. Teleflex, Inc.*, 127 S. Ct. 1727, 1741 (2007). To protect against conclusory rejections and impermissible hindsight, an Examiner's assessment of what is known in the art must be based on citation to record evidence, not on mere speculation. *In re Zurko*, 258 F.3d 1379, 1385 (Fed. Cir. 2001).

In the present case, however, the Examiner suggests – without explanation or citation to record evidence – that one of skill in the art would overlook the teaching away in Cable '903 to arrive at the bound electrode-electrolyte assemblies of the claimed invention (final office action at page 36). But the Examiner cites no record evidence to explain why one of skill in the art would disregard this express teaching away, and the Examiner's failure to justify why one of skill in the art would ignore the teaching away in the prior art is reversible error. *See W.L. Gore*, 721 F.2d at 1552 (reversing obviousness rejection where trial court failed to explain why those skilled in the art would have disregarded teaching away contained in cited references). The pending rejections should be reconsidered and withdrawn.

F. The Rejections Under the Cable-Isenberg-Keegan Combination Should be Withdrawn Because the Combination Fails to Address Every Claim Limitation

Even if the Cable-Isenberg combination were proper – which Appellants do not concede– the Examiner's addition of Keegan (U.S. Pat. 6,423,896) nevertheless fails to address every element of the pending claims. Accordingly, the combination cannot support the proposed obviousness rejection.

Claim 62 recites, *inter alia*, direct operation on hydrocarbon fuels that have two or more carbons and that do not undergo prior treatment to remove organic sulfur compounds. The Examiner freely concedes that neither Cable '903 nor Isenberg, singly or in combination, teaches this limitation of the pending claims, and relies on Keegan to cure the other references' acknowledged deficiencies (final office action at pages 5-7).

Keegan, however, does not cure these deficiencies, because the reference does not describe fuel cells capable of directly operating on hydrocarbons that do not undergo prior treatment. A review of Keegan and a comparison with the pending claims makes this clear.

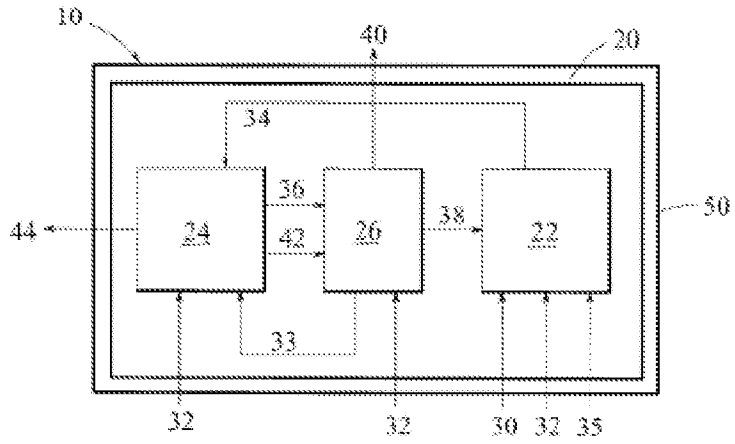
The pending claims recite devices "capable of directly operating with a sulfur-containing hydrocarbon fuel that does not undergo prior treatment." Keegan, however, provides no such teaching. Although Keegan discusses some fuels, Keegan also states that such fuels must undergo reformation or other prior treatment **before** the fuel cell operates on the fuel:

> "Located within the fuel cell system enclosure 20, ***is the reformer system*** 22 that comprises a main reformer, and optionally, a micro-reformer. The reformer 22 is provided with a fuel through a fuel inlet 30, an exterior air (or oxidant) inlet 32 , and a water supply inlet 35 . The reformer system 22 is thermally isolated from the fuel cell stack 24 , (i.e., a segmented enclosure, isolated enclosure, or the like). ***The processing or reforming of hydrocarbon fuels, such as gasoline, is completed to provide an immediate fuel source for rapid start up of the fuel cell as well as protecting the fuel cell by removing impurities. The reformer system 22 , preferably utilizing a steam reformer, creates a reformate 34 for use by the fuel cell stack 24.***" (Keegan at col. 2, line 66 – col. 3, line 15) (emphasis added)

> "***During operation of the fuel cell system, a hydrocarbon fuel is directed to a reformer where the fuel is processed into a reformate for use by the fuel cell stack***. The fuel cell stack uses the reformate to create electrical energy for harnessing, as well as producing thermal energy as a byproduct." (Keegan at col. 4, line 65 – col. 5, line 2) (emphasis added)

Figure 1 of Keegan likewise emphasizes that the reference teaches that fuels must be reformed before being further processed by a fuel cell. In that figure (reproduced below for ease of reference), the fuel enters the device only by way of inlet **30**, after which it is processed by the reformer **22** (see Keegan at col. 2, line 66 – col. 3, line 4). Only ***after*** the fuel is processed/reformed does the processed fuel enter the fuel cell stack **24**.

FIG. 1



Thus, Keegan teaches ***only*** that hydrocarbon fuels – including those having two or more carbons – are reformed or pre-treated before they are used by a fuel cell. By contrast, the claimed devices are capable of using fuels that ***do not*** undergo pretreatment, which is qualitatively different than what Keegan describes.

b. The Rejection Of Claim 63 Over Cable '903 In View Of Isenberg And Keegan Should be Withdrawn

The Examiner alleges that claim 63 is obvious over Cable (U.S. Patent 5,445,903) in view of Isenberg (U.S. Patent 4,812,329) and Keegan (U.S. Patent 6,423,896) (final office action at pages 3-8). Because the proposed combination of references is improper and because the combination does not suggest or otherwise address every element of the cited claims, this rejection should be withdrawn.

i. Technical Background – Claim 63

As set forth in the claims appendix attached hereto, independent claim 63 recites processes of producing electrical energy. These processes include, *inter alia*, providing a solid oxide fuel cell system and operating the system with a sulfur-containing hydrocarbon fuel. The fuel cells suitably include an anode bound to an electrolyte. The power production suitably includes contacting the anode of the fuel cell with the sulfur-containing fuel and contacting the cathode of the fuel cell with oxygen.

ii. Argument – Claim 63

For substantially the same reasons given in connection with claim 62, the rejections of claim 63 should be withdrawn.

c. The Rejection Of Claim 64 Over Cable '903 In View Of Isenberg And Keegan, As Applied To Claims 62, 63, 65, and 66, in Further View of Cable '285 Should Be Withdrawn

The office action alleges that claim 64 is obvious over Cable '903 in view of Isenberg and Keegan, as applied to claims 62, 63, 65, and 66, in further view of Cable '285. For the reasons set forth in detail above in connection with claim 62, this rejection should be reconsidered and withdrawn.

Claim 64 is a fuel cell system analogous to the system recited in claim 62, with the principal difference between the two being that the fuel cells of claim 64 include copper disposed within the pores of their anodes. For the reasons explained in connection with claim 62, the Cable (285 and 903)-Isenberg-Keegan combination does not make out a *prima facie* case of obviousness, and all rejections based on those references should be reconsidered and withdrawn.

d. The Examiner's Attempts To Rebut Appellants' Arguments Are Contrary To Controlling Law And To The Content Of The Prior Art Upon Which The Examiner Relies

Attempting to justify the legally erroneous rejections, the Examiner argues that the express teaching away contained in the cited references can be ignored. The Examiner's rebuttal positions are, however, legally and factually incorrect.

The Examiner first suggests that Cable 903's teaching away from Isenberg and from the claimed invention is "irrelevant" (final office action at 22). Appellants respectfully submit that teaching away is relevant at all times in every obviousness rejection. *See Ecolochem*, 227 F.3d at 1373-75 (reversing district court's finding of obviousness where

cited references taught away from their combination); *In re Grasselli*, 713 F.2d at 743 (references that taught away from their combination cannot be combined to support obviousness rejection).

The Examiner also suggests that Isenberg can be combined with Cable despite the express teaching away because Isenberg is "only being relied upon to provide ceria into the pores for sulfur tolerance purposes" (final office action at 22). But this suggestion misapplies the law and ignores the content of the references upon which the Examiner relies.

First, the Examiner's suggestion that one can selectively pluck particular elements from several prior art references to arrive at the claimed invention is contrary to the requirement that a rejection must account for ***every*** part of a prior reference, including portions that lead away from the claimed invention. *See W.L. Gore*, 721 F.2d at 1550 (error to "disregard[ ] disclosures in the references that diverge from and teach away from the invention at hand"). An obviousness rejection cannot be cobbled together by citing only those aspects of the prior art that are most favorable to the rejection and disregarding those aspects of the prior art that teach away from the claimed invention. *Id.* To allow obviousness rejections to be constructed in such an unbounded way invites rejections based on no more than hindsight, which the Federal Circuit has condemned. *E.g.*, *Life Techs., Inc. v. Clontech Lab., Inc.*, 224 F.3d 1320, 1326 (Fed. Cir. 2000) (vacating obviousness rejection where rejection was based on "impermissible use of hindsight"). If the Examiner's position were the controlling law, the PTO and courts alike could construct a claimed invention by cherry-picking individual elements from various references, without regard for the references' true teachings. That is not, and never has been, the law.

The Examiner's attempt to sidestep governing case law on teaching away also ignores the facts of record. To the extent Isenberg may "provide ceria into the pores for sulfur tolerance purposes," the very Cable reference upon which the Examiner relied stated that when operated with sulfur-containing fuels, such ceria-containing electrodes:

> "experienced ***4.7% performance loss***. Extended operation, or thermal cycling caused the anode coating to crack and flake off, however, and resulted in the poisoning of the underlying bonded anode . . . [a subsequent U.S. Department of Energy] report concluded that ***cell performance degraded rapidly for about the first two hours of sulfur bearing fuel utilization, and at a slow, linear rate thereafter, in the presence of as low as 2 ppmv H_2S in the fuel***. Cable 285 at col. 2, lines 14-45.

Accordingly, the Examiner's suggestion that one of skill in the art would "pluck" ceria from the Isenberg reference for combination with Cable cannot be reconciled with the fact that Cable states – by reference to actual test data – that ceria-containing electrodes experienced "rapid" performance degradation when exposed to fuels having only trace amounts of sulfur. While the Examiner suggests that one of skill in the art would ignore the express teaching away and "pluck" ceria from the Isenberg references, the Examiner does not explain why one of skill would do so when the evidence of record was that ceria-containing fuel cells performed poorly when exposed to sulfur-containing fuels. *See KSR*, 127 S. Ct. at 1739-43 ("rejections on obviousness grounds ***cannot be sustained by mere conclusory statements***; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness") (emphasis added). Because the Examiner's positions are contrary to controlling case law and to the facts of the present case, they are accordingly without merit.

* * * * *

In sum, the proposed reference combination cannot support a *prima facie* case of obviousness, and the pending rejections should be withdrawn. First, the Cable-Isenberg combination is improper and cannot support a *prima facie* case of obviousness. Cable ***expressly criticizes*** the bonded electrodes recited in Isenberg, and accordingly teaches away from combination with Isenberg and away from the claimed invention. While the Examiner suggests that Cable does disclose bonded electrodes, that suggestion is based on a misreading of the Cable reference and cannot be reconciled with the fact that the Cable reference criticizes such electrodes. The Examiner provides no citation to any record evidence or case law to support the position that one skilled in the art would ignore this express teaching away.

The Examiner also alleges that Keegan addresses the claim limitations regarding direct operation with hydrocarbon fuels. But Keegan discloses qualitatively different fuel cells that operate on pre-treated or reformed fuels, ***not*** fuel cells that operate on ***un***treated fuels. The proposed reference combinations thus fail to address every element of the pending claims, and do not make out a *prima facie* case of obviousness. Accordingly, the Examiner's proposed reference combinations cannot support an obviousness rejection, and the rejections of independent claims 62-64 (and all related claims) should be vacated and the claims passed to allowance.

e. Separate Argument for Dependent Claims

i. The Rejections Of Claims 4, 13, 14, And 23 Over Cable '903 In View Of Isenberg and Keegan, As Applied To Claims 62, 10-12, 63, and 22 in Further View of Anumakonda Should Be Withdrawn

The Examiner alleges that claims 4, 13, 14, and 23 are obvious over Cable '903 in view of Isenberg and Keegan, as applied to claims 62, 10-12, 63, and 22, and in further view of Anumakonda (U.S. Pat. 6,221,280). For purposes of this appeal, these rejections will stand or fall together with claims 62 and 63, and for the reasons described above, all of these rejections should be reconsidered and withdrawn. Anumakonda – like Keegan – recites reformation of sulfur-containing fuels to hydrogen and carbon monoxide **before** the fuel cell operates on the fuels (Anumakonda at, *e.g.*, col. 7, lines 40-44, col. 8, lines 30-48).

ii. The Rejections Of Claims 17 and 19 Over Cable '903 In View Of Isenberg And Keegan, As Applied To Claims 62, 15, and 16, in Further View of Wallin Should Be Withdrawn

The office action alleges that claims 17 and 19 are obvious over Cable '903 in view of Isenberg and Keegan, as applied to claims 62, 15, and 16, and in further view of Wallin (U.S. Pat. 6,017,647). For purposes of this appeal, these rejections will stand or fall together with claim 62.

iii. The Rejections Of Claims 55, 56, and 60 Over Cable '903 In View Of Isenberg And Keegan, As Applied To Claims 62, 63, 65, and 66, in Further View of Cable '285 Should Be Withdrawn

The office action alleges that claims 55, 56, and 60 are obvious over Cable '903 in view of Isenberg and Keegan, as applied to claims 62, 63, 65, and 66, in further view of Cable (U.S. Pat. 5,589,285). For purposes of this appeal, these rejections will stand or fall together with claims 62 and 63.

iv. The Rejection Of Claim 58 Over Cable '903 In View Of Isenberg And Keegan, As Applied To Claims 62, 63, 65, and 66, in Further View of Cable '285 Should Be Withdrawn

The office action alleges that claim 58 is obvious over Cable '903 in view of Isenberg and Keegan, as applied to claims 62, 63, 65, and 66, in further view of Cable '285. For purposes of this appeal, these rejections will stand of fall together with claims 62 and 63.

D. Conclusion

For the foregoing reasons, Appellants submit that the rejections under 35 U.S.C. § 103(a) of independent claims 62-64 and of all related dependent claims be reconsidered and withdrawn. The pending rejections are first improper because the primary references on which the office action relies – Cable and Isenberg – ***expressly*** teach away from combination with one another and away teach from the claimed invention. References that contain such a teaching away cannot support a *prima facie* case of obviousness, and the Examiner provides no articulated reasoning to explain why one of skill in the art would ignore this teaching away. Even if the Cable-Isenberg combination were proper – which Appellants do not concede – the addition of the Keegan reference to cure the admitted shortcomings of the Cable-Isenberg combination does not support a *prima facie* case of obviousness, as Keegan does not address the claim element of fuel cells that operate on fuels that do not undergo pretreatment, such as reformation. Accordingly, Appellants respectfully request that the Board vacate the rejections of the pending claims and pass all pending claims to allowance.

Should any member of the Board believe that additional communication will expedite prosecution of this application, the undersigned may be reached at the telephone number provided.

Date: December 8, 2009

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8. CLAIMS APPENDIX

1. (Canceled)

2. (Previously presented) The fuel cell according to claim 62, wherein the hydrocarbon is a petroleum distillate.

3. (Previously presented) The fuel cell according to claim 2, wherein the petroleum distillate is selected from the group consisting of gasoline, diesel oil, naphtha, JP-4, JP-5, JP-8, kerosene, motor oil, natural gas, fuel oil, and mixtures thereof.

4. (Previously presented) The fuel cell according to claim 3, wherein the petroleum distillate is selected from the group consisting of JP-4, JP-5, JP-8, and mixtures thereof.

5. (Previously presented) The fuel cell according to claim 3, wherein the petroleum distillate is selected from the group consisting of naptha, kerosene, fuel oil, and mixtures thereof.

6. (Previously presented) The fuel cell according to claim 3, wherein the petroleum distillate is selected from the group consisting of gasoline, diesel oil, natural gas, and mixtures thereof.

7. (Original) The fuel cell according to claim 2, wherein the hydrocarbon comprises an alcohol.

8. (Previously presented) The fuel cell according to claim 7, wherein the alcohol comprises ethanol.

9. (Previously presented) The fuel cell according to claim 2, wherein the hydrocarbon is selected from the group consisting of butane, toluene, decane, and mixtures thereof.

10. (Previously presented) The fuel cell according to claim 62, wherein the sulfur containing

hydrocarbon fuel has a sulfur content of from about 1 ppm to about 1000 ppm.

11. (Previously presented) The fuel cell according to claim 10, wherein the sulfur-containing hydrocarbon fuel has a sulfur content of from about 10 ppm to about 1000 ppm.

12. (Previously presented) The fuel cell according to claim 11, wherein the sulfur-containing hydrocarbon fuel has a sulfur content of from about 20 ppm to about 1000 ppm.

13. (Previously presented) The fuel cell according to claim 12, wherein the sulfur-containing hydrocarbon fuel has a sulfur content of from about 100 ppm to about 1000 ppm.

14. (Previously presented) The fuel cell according to claim 13, wherein the sulfur-containing hydrocarbon fuel has a sulfur content of from about 250 ppm to about 1000 ppm.

15. (Previously presented) The fuel cell system according to claim 62 wherein the solid electrolyte is an oxide ion conducting material.

16. (Previously presented) The fuel cell according to claim 15, wherein the oxide ion conducting material is selected from the group consisting of doped ceria, doped zirconia, and doped lanthanum gallate.

17. (Previously presented) The fuel cell according to claim 16, wherein the doped ceria is selected from the group consisting of gadolinium doped ceria, samarium-doped ceria, yttria-doped ceria, and mixtures thereof.

18. (Previously presented) The fuel cell according to claim 15, wherein the oxide ion conducting material is yttria-doped zirconia.

19. (Previously presented) The fuel cell according to claim 16, wherein the doped zirconia is scandium-doped zirconia.

20. (Canceled)

21 (Previously presented) The process according to claim 63, wherein the hydrocarbon is a petroleum distillate.

22. (Previously presented) The process according to claim 21, wherein the petroleum distillate is selected from the group consisting of gasoline, diesel oil, naphtha, JP-4, JP-5, JP-8, kerosene, motor oil, natural gas, fuel oil, and mixtures thereof.

23. (Previously presented) The process according to claim 22, wherein the petroleum distillate is selected from the group consisting of JP-4, JP-5, JP-8, and mixtures thereof.

24. (Previously presented) The process according to claim 22, wherein the petroleum distillate is selected from the group consisting of naphtha, kerosene, fuel oil, and mixtures thereof.

25. (Original) The process according to claim 22, wherein the petroleum distillate comprises gasoline.

26. (Original) The process according to claim 22, wherein the petroleum distillate comprises diesel oil.

27. (Previously presented) The process according to claim 63, wherein the hydrocarbon is selected from the group consisting of alcohols, butane, toluene, decane, and mixtures thereof.

28. (Original) The process according to claim 27, wherein the hydrocarbon comprises an alcohol.

29. (Previously presented) The process according to claim 28, wherein the alcohol comprises ethanol.

30. (Previously presented) The process according to claim 63, wherein the sulfur containing hydrocarbon has a sulfur content of from about 10 ppm to about 1000 ppm.

31. – 53. (Canceled without prejudice)

54. (Canceled)

55. (Previously presented) The fuel cell system of claim 62, wherein the anode further comprises copper deposited in the pores.

56. (Previously presented) The process of claim 63, wherein the anode further comprises copper deposited in the pores.

57. (Canceled)

58. (Canceled) The fuel cell system of claim 64, wherein the anode further comprises copper deposited in the pores.

59. (Canceled)

60. (Canceled) The process of claim 66, wherein the anode further comprises copper deposited in the pores.

61. (Canceled)

62. (Previously presented) A solid oxide fuel cell system capable of directly operating with a sulfur-containing hydrocarbon fuel that does not undergo prior treatment to remove organic sulfur compounds, comprising:

(a) a solid electrolyte comprising an electronic insulator that allows transfer of anions;

(b) an essentially nickel-free porous anode containing at least ceria deposited in the pores, the anode further comprising a ceramic, and at least a portion of the anode being bound to the electrolyte;

(c) a cathode;

(d) a fuel comprising a hydrocarbon having 2 or more carbons, and the fuel being characterized as having a sulfur content of from about 1 ppm to about 5000 ppm; and

(e) an oxygen source;

wherein the solid electrolyte and the porous anode overlap one another so as to define a region of physical contact between one another, the region of physical contact being characterized as an essentially uninterrupted interface.

63. (Previously presented) A process of producing electrical energy, comprising:

(a) providing a solid oxide fuel cell system capable of directly operating with a sulfur-containing hydrocarbon fuel that does not undergo prior treatment to remove organic sulfur compounds, the solid oxide fuel cell system comprising:

a solid oxide electrolyte comprising an electronic insulator that allows transfer of anions;

an essentially nickel-free porous anode containing at least ceria deposited in the pores, the anode further comprising a ceramic, and at least a portion of the anode being bound to the electrolyte; and

a cathode, and

a fuel comprising a hydrocarbon having two or more carbons, and the fuel being characterized as having a sulfur content of from about 1 ppm to about 5000 ppm,

wherein the solid electrolyte and the anode overlap one another so as to define a region of physical contact between one another, the region of physical contact being characterized as an essentially uninterrupted interface,

(b) contacting the cathode with an oxygen source; and

(c) contacting the porous anode with the fuel.

64. (Previously presented) A solid oxide fuel cell system capable of directly operating with a sulfur-containing hydrocarbon fuel that does not undergo prior treatment to remove organic sulfur compounds, comprising:

(a) a solid electrolyte comprising an electronic insulator that allows transfer of anions;

(b) an essentially nickel-free porous anode containing at least copper deposited in the pores, the anode further comprising a ceramic, and at least a portion of the anode being bound to the electrolyte;

(c) a cathode;

(d) a fuel comprising a hydrocarbon having 2 or more carbons, and the fuel being characterized as having a sulfur content of from about 1 ppm to about 5000 ppm; and

(e) an oxygen source;

wherein the solid electrolyte and the porous anode overlap one another so as to define a region of physical contact between one another, the region of physical contact being characterized as an essentially uninterrupted interface.

65. (Canceled)

66. (Canceled) A process of producing electrical energy, comprising:

(a) providing a solid oxide fuel cell system capable of directly operating with a sulfur-containing hydrocarbon fuel, the solid oxide fuel cell comprising

a solid oxide electrolyte that is an electronic insulator that allows transfer of anions,

an essentially nickel-free porous anode, the anode further comprising a ceramic, the anode containing at least copper ~~ceria~~ deposited in the pores and comprising a porous ceramic, and at least a portion of the anode being bound to the electrolyte, and

a cathode,

(b) contacting said cathode with an oxygen source; and

(c) contacting said porous anode with a fuel comprising a hydrocarbon having two or more carbons, the fuel being characterized as having a sulfur content of from about 1 ppm to about 5000 ppm,

wherein the solid electrolyte and the porous anode overlap one another so as to define a region of physical contact between one another, the region of physical contact being characterized as an essentially uninterrupted interface.

67. (Canceled)

68. (Canceled) The process according to claim 66, wherein the hydrocarbon is selected from the group consisting of alcohols, a petroleum distillate, butane, toluene, decane, or any combination thereof.

9. EVIDENCE APPENDIX

Attached hereto is the January 26, 2009 declaration of Dr. Raymond J. Gorte.

DOCKET NO.: UPFF-0004 / N2437 PATENT
Application No.: 10/053,085
Office Action Dated: October 9, 2008

In re Application of:
Raymond J. Gorte and John M. Vohs Confirmation No.: **5527**

Application No.: **10/053,085** Group Art Unit: **1795**

Filing Date: **November 9, 2001** Examiner: **Wang, Eugenia**

For: **Use of Sulfur-Containing Fuels for Direct Oxidation Fuel Cells**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

DECLARATION OF DR. RAYMOND J. GORTE UNDER 37 C.F.R. § 1.132

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

I, Raymond J. Gorte, Ph.D., hereby declare the following:

1. I am a co-inventor of the above-captioned patent application ("the subject application"). My Curriculum Vitae is enclosed as **Exhibit A**. Among my credentials, I earned a Ph.D. in Chemical Engineering from the University of Minnesota, in Minneapolis, Minnesota. I am a senior technical advisor to Franklin Fuel Cells, the company seeking to commercialize the technology set forth in the above-captioned patent application.

2. I have performed research into catalysis and fuel cells relevant to the work described in this patent application as professor at the University of Pennsylvania. Franklin Fuel Cells was founded to move the research into the product phase.

DOCKET NO.: UPFF-0004 / N2437 **PATENT**
Application No.: 10/053,085
Office Action Dated: October 9, 2008

3. It is my understanding that claims 2-19, 21-30., 55, 56, 58, 60, and 62-67 of the subject application are directed toward solid oxide fuel cells capable of operation with sulfur-containing hydrocarbon fuels.

4. I have reviewed the Office Action dated October 9, 2008. As I understand it, the Examiner has rejected independent claims 62-67 and those claims that depend from these claims for allegedly being obvious in light of the prior art, in particular U.S. Patents 5,445,903 (Cable) and 4,812,329 (Isenberg).

5. This declaration is made to demonstrate that fuel cells recited in claims 62-67 were not obvious at the time that the application was filed.

6. Based on my experience in the field of catalysis and fuel cells and my own observations and tests, the invention of the instant application achieves results that are unexpectedly superior to those of alternative devices in the field.

7. I understand that the Patent Office is of the view that although Isenberg discloses only operation with H_2, CO, and CH_4 as fuels, devices that result from the hypothetical combination of Cable and Isenberg references could nonetheless operate using hydrocarbon fuels having two or more carbons ("C2+ hydrocarbons") and having a sulfur content of from about 1 to about 5000 ppm.

8. The Patent Office's position is mistaken. Based on my experience in the field, H2, CO, and CH4 behave very differently from C2+ hydrocarbons when used as fuels in solid oxide fuel cells, and CH_4 would specifically behaves like CO, not like a C2+ hydrocarbon.

9. Based on my experience, a nickel-based fuel cell may operate on CH_4 or H_2. Cells according to the references cited by the Patent Office, however, would form undesirable carbon deposits when run on C2+ hydrocarbon fuels. Because these deposits are difficult to avoid, one of skill in the art at the time of the subject application would not have used the

devices described in either the Isenberg or Cable references in conjunction with C2+ hydrocarbon fuels.

10. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Dated: January 26, 2009

/Raymond J. Corte, Ph.D./
Raymond J. Corte, Ph.D.

Attachments:
Exhibit A

10. RELATED PROCEEDINGS APPENDIX

No related appeals or interferences are currently pending.